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Indian Standard

SPECIFICATION FOR INSULATING MATERIALS BASED ON BUILT-UP MICA OR TREATED MICA PAPER

PART III SPECIFICATIONS FOR INDIVIDUAL MATERIALS

Section 2 Moulding Mica Materials for Electrical Purposes

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Section 2 Moulding Mica Materials for Electrical Purposes

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Indian Standard

SPECIFICATION FOR INSULATING MATERIALS BASED ON BUILT-UP MICA OR TREATED MICA PAPER

PART III SPECIFICATIONS FOR INDIVIDUAL MATERIALS

Section 2 Moulding Mica Materials for Electrical Purposes

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 October 1982, after the draft finalized by the Solid Electrical Insulating Materials Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard deals with built-up mica or treated mica papers for use in electrical equipment. It consists of the following three parts:

Part I Definitions and General Requirements,

Part II Methods of Test, and

Part III Specifications for Individual Materials.

0.3 This standard (Part III/Section 2) covers requirements for moulding mica sheets for electrical purposes.

0.4 This standard should be read in conjunction with IS : 9299 (Part I)-1979* and IS : 9299 (Part II)-1979*.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Specification for insulating materials based on built-up mica or treated mica paper:
Part I Definitions and general requirements.
Part II Methods of test.

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part III/Sec 2) applies to various types of hot mouldable sheets based on mica flakes/paper for electrical purposes.

1.2 The grades of sheets and corresponding temperature index covered by this standard are given in Table 1.

TABLE 1 GRADE OF SHEETS

Sl No.	Type of Sheet	Typical Binder*	Temperature Index Grade
1. a.	Unmilled built-up mica	Organic (shellac, alkyd)	130
1. b.	Milled built-up mica	Organic (shellac, alkyd)	130
2. a.	Unmilled built-up mica	Organic (modified alkyd, epoxy)	155
2. b.	Milled built-up mica	Organic (modified alkyd, epoxy)	155
3. a.	Unmilled built-up mica	Silicone	180
3. b.	Milled built-up mica	Silicone	180
4.	Unmilled mica paper	Organic (shellac, alkyd)	130
5.	Unmilled mica paper	Organic (modified alkyd, epoxy)	155
6.	Unmilled mica paper	Silicone	180

*The typical type of binders are given in the table for guidance only. Any other type of binders are permitted to be used, provided the product meets the requirements of the standard.

2. GENERAL REQUIREMENTS

2.1 The material, as supplied, shall be of uniform texture free from hard patches, through holes and foreign matter.

2.2 The sheets shall be of rectangular shape with neatly trimmed edges and without delamination. The sheet surface shall be reasonably smooth and shall not be tacky.

2.3 The bonding medium used shall be as agreed to between the supplier and the purchaser. The material when tested in accordance with the methods given in IS : 9299 (Part II)-1979* shall comply with all the requirements of this standard.

2.4 The thickness of the sheet shall be between 0·1 mm to 1·5 mm for unmilled form and 0·4 mm to 1·5 mm for milled form and shall be made of muscovite or phlogopite mica built up from mica splits or mica paper by the use of the suitable binding medium.

3. TESTS

3.1 Type Tests — The following tests will constitute type tests.

- a) Thickness,
- b) Dimensions,
- c) Mica content,
- d) Mouldability,
- e) Transverse electric strength,
- f) Tensile breaking strength and elongation at break,
- g) Detection of faults and conductive particles, and
- h) Volume resistivity.

3.2 Routine Tests — The following tests will constitute the routine tests:

- a) Thickness,
- b) Dimensions,
- c) Mica content,
- d) Mouldability,
- e) Transverse electric strength, and
- f) Detection of faults and conductive particles.

3.3 Thickness

3.3.1 The thickness of the sheets as received shall be measured in accordance with **2** of IS : 9299 (Part II)-1979*.

3.3.2 The tolerance on sheet thickness related to the nominal thickness are given in Table 2.

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*Specification for insulating materials based on built-up mica or treated mica paper: Part II Methods of test.

TABLE 2 TOLERANCE ON SHEET THICKNESS

(*Clause* 3.3.2)

All dimensions in millimetres.

Sl No.	Type of Sheet	Nominal Thickness	Tolerance Limits	
			Average	At Individual Points
(1)	(2)	(3)	(4)	(5)
1.	Organic bonded built-up mica, unmilled	0·10	+ 0·05 – 0·04	+ 0·10 – 0·05
		0·15, 0 20 and 0·25	± 0·05	± 0·10
		0·30 and 0·35	± 0·05	± 0·12
		0·40 and 0·45	± 0·06	± 0·15
		0·50	± 0·08	± 0 18
		0·60	± 0·09	± 0·18
		0·70	± 0·10	± 0·21
		0·80	± 0·12	± 0·24
		0·90	± 0·13	± 0·27
		1·00	± 0·15	± 0·30
		1·50	± 0·22	± 0·45
		Over 1·50†	± 15%	± 30%
2.	Organic or silicone bonded built-up mica, milled	0·4 to 1·5	± 0·05	± 0·08
3.	Silicone bonded built-up mica, unmilled	0·15, 0·20 and 0·25	± 0·05	± 0·10
		0·30 and 0·35	± 0·05	± 0·12
		0·40 and 0·45	± 0·06	± 0·15
		0·50†	± 0·08	± 0·18

*The nominal thickness is that stated when ordering, being the thickness of the material to be delivered.

†Sheets thicker than 1·5 mm on organic bonded, milled or unmilled and that on silicone bonded built-up mica thicker than 0·5 mm may be manufactured and supplied subject to agreement between the supplier and the purchaser.

3.4 Dimensions

3.4.1 The tolerance on length and breadth of sheet shall be as follows:

a) Up to 500 mm	± 10 mm, and
b) Over 500 mm	± 15 mm.

3.5 Composition

3.5.1 The content of mica binder, etc, in the sheet shall be as indicated in Table 3 and shall be determined according to method given in **3** of IS : 9299 (Part II)-1979*.

TABLE 3 COMPOSITION OF SHEETS

SL No.	TYPE OF SHEET	CONTENT IN PERCENTAGE		
		Mica	Binder	Volatile Matter
1.	Organic bonded, built-up mica, milled/unmilled	80-88	12-20	Less than 1
2.	Silicone bonded, built-up mica, milled/unmilled	80-90	10-20	Less than 1
3.	Organic or silicone bonded mica paper, unmilled	75 *Min*	25 *Max*	Less than 1

3.6 Mouldability

3.6.1 When heated under pressure, the sheet shall be capable of being moulded into pipes.

3.6.2 To determine the mouldability of sheet, a sample, 50 mm wide and having a length of not less than twice the circumference of test mandrel shall be taken. The test mandrel diameter shall be equal to 50 times the sheet thickness or 50 mm, whichever is less.

3.6.3 *Procedure* — Heat the sample and mandrel as per the details given below for different types of sheets:

a) Shellac/alkyd bonded sheets at 110 ± 10°C for 15 minutes,

b) Modified alkyd/epoxy bonded sheets at 160 ± 10°C for 30 minutes, and

c) Silicone bonded sheets at 200 ± 10°C for 30 minutes.

Wrap the sample quickly around a mandrel and allow it to cool down to 27 ± 2°C. Remove the mandrel and tape.

3.6.4 The mica in the pipe form thus obtained shall not flake off and the sheet shall retain the moulded shape without laminations. The samples of similicone bonded sheet having minor scaling off mica shall be considered as meeting the requirements of this test.

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*Specification for insulating materials based on built-up mica or treated mica paper: Part II Methods of test.

3.7 Transverse Electric Strength

3.7.1 The average of the electrical breakdown strength of the sheet for 5 samples shall not be less than the values specified in Table 4. The minimum value out of the five readings shall not be less than the 75 percent of the value given in Table 4.

TABLE 4 BREAKDOWN VOLTAGE

Sl No.	Type of Sheet	Nominal Thickness	Average Breakdown Voltage kV/mm (*Min*)
(1)	(2)	(3)	(4)
1.	Organic or silicon bonded, built-up mica sheet, unmilled	0·1 to 1·5 mm	22
2.	Organic bonded, built-up mica sheet, milled	0·4 to 0·9 mm	26
		Above 0·9 mm	22
3.	Silicone bonded, built-up mica sheet, milled	0·4 to 0·9 mm	22
		Above 0·9 mm	18
4.	Organic *silicon* bonded, mica paper, unmilled	0·25-1·6 mm	34

3.7.2 The test shall be carried out according to IS : 2584-1963*. The breakdown test with rapidly applied voltage shall be used as described in **7.1** of IS : 2584-1963*.

3.8 Tensile Breaking Strength and Elongation at Break

3.8.1 The test shall be carried out according to **7** of IS : 9299 (Part II)-1977†.

3.8.2 The tensile strength at break so measured shall not be less than 5 KN/cm^2.

3.9 Detection of Faults and Conductive Particles

3.9.1 The maximum permissible number of defects (to be eliminated by punching the faulty area) shall be 4 per square metre.

3.9.2 Apply an alternative voltage of 2 kV 50 Hz on the sample, which is obtained by passing the sample at a speed of 3 m/minute between two cylinders of 80 mm diameter. In the event of detection of particles or electrical breakdown, the defect is eliminated by punching it out in circles of 10 mm diameter around the defect.

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*Method of test for electric strength of solid insulating materials at power frequencies.

†Specification for insulating materials based on built-up mica or treated mica paper: Part II Methods of test.

3.9.3 Count the number of faults in the sample and divide by area of the sample.

3.10 Volume Resistivity

3.10.1 The volume resistivity of sheet on alkyd resin or shellac bond shall be checked in accordance with IS : 3396-1965*. The values shall be as specified in Table 5.

TABLE 5 REQUIREMENTS OF VOLUME RESISTIVITY OF SHEETS

SL No.	TYPE OF SHEET	MINIMUM VOLUME RESISTIVITY (Ω.cm) AFTER A HOLDING PERIOD OF	
		18 Hours at a Relative Humidity of 65 ± 5 Percent and a Temperature of 20 ± 5°C	48 Hours at a Relative Humidity of 95 ± 3 Percent and a Temperature of 20 ± 5°C
1.	Made from muscovite mica or mixture of muscovite and phlogopite mica	10^{13}	10^{12}
2.	Made from phlogopite mica	10^{13}	10^{11}

4. DENSITY

4.1 The density of all types of sheets shall be in the range of 1·9 to 2·2 kg/dm³.

5. SUPPLY AND PACKING CONDITIONS

5.1 The materials shall be supplied generally in sheets, approximately 800 mm in length and 500 mm in width in any other size as agreed to between the supplier and the purchaser.

5.2 The sheets of same grade, thickness, width, length and bonding material shall be interleaved with paper/polythene sheets and assembled in packages. The package shall be wrapped in moisture-proof paraffin paper or polythene sheets and placed snugly in solid wooden cases, ensuring that the packaging is adequate for the material to be delivered in good condition.

5.3 The user shall store the product in their original packages, in a place protected from heat and damp.

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*Methods of test for volume and surface resistivities of electrical insulating materials.

6. MARKING

6.1 Each consignment shall be marked indelibly with the following information:

a) Name of the manufacturer,
b) Type of binder and mica,
c) Grade of sheet,
d) Thickness of sheet in mm,
e) Weight of sheet in kg,
f) Lot number and date (month and year) of manufacture,
g) Temperature index of sheet, and
h) Shelf life of the sheet.

6.2 The mica sheet may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7. SAMPLING

7.1 Sampling shall be as agreed to between the supplier and the purchaser.